

REMARKS

Claims 1 and 55-61, 63-79 and 81-83 are pending in this application.

Claims 1, 55, 61, 63-69, 77, 79 and 81 are rejected under 35 USC 103(a) as being unpatentable over US Patent 6,671,055 Wavering in view of US Patent 5,315,110 to Smith. Claims 56-60, 70-76 and 78 are rejected under 35 USC 103(a) as being unpatentable over Wavering in view of Smith and further in view of US Patent 5,345,519 to Lu. Claims 82-83 are rejected under 35 USC 103(a) as being unpatentable over Wavering in view of Smith and further in view of US Patent 5,872,876 to Kluth *et al.*

Claim 1, which is the only independent claim, is amended above to improve its readability, and stands rejected as being obvious over a combination of Wavering and newly cited Smith. The Examiner states that Wavering discloses a sensor with a pressure sensing region and a temperature sensing region, wherein the pressure sensing region comprises a cavity (30), a diaphragm (40) and a plurality of reflecting surfaces. (Final Office Action at page 2, para. 2). The Examiner then reasons that while Wavering does not disclose using the sensor in a downhole environment, this deficiency is remedied by newly cited Smith. Applicants respectfully traverse.

First, Applicants note that claim 1 was previously amended to delete the limitation “cavity.” It was also previously amended to add the following structural limitation:

the launch waveguide is connected to a housing and when the housing is exposed to a pressure at a predetermined downhole location in an oil or gas well, and the exposure to the downhole pressure changes the dimensions of at least a portion of the housing to change the distance between the first and second reflecting surfaces, such that the pressure and temperature can be measured.

(emphasis added). Applicants had argued in the first Amendment that it is the above quoted structural limitation describing the housing, which allows the sensor to be used downhole, not necessarily the intended use that is missing from Wavering.

Second, the Wavering reference pointedly critiques and distinguishes prior temperature-compensated pressure-only sensor from sensors that can measure both temperature and pressure. Specifically, the Wavering reference teaches that

[t]hese prior approaches have many limitations. Any

approach that uses a mechanical means for thermally compensating pressure is limited in size, operating temperature, accuracy, commercialization, as well as *it does not actually provide a temperature measurement.*

(emphasis added.) Hence, Wavering specifically teaches away from optical temperature-compensated pressure sensor. Unlike claim 1, the newly cited Smith reference is such a temperature-compensated pressure sensor.

Smith discloses a highly complex mechanical temperature compensation scheme. Smith teaches an optical interferometer for measuring pressure but not temperature, which includes a plurality of support members. These support members have different coefficients of thermal expansion, such that when the sensor is heated to downhole temperature, the thermal expansions of the support members mutually offset each other. This offset prevents the thermal expansions from interfering with the pressure measurements. (See Abstract).

More specifically, changes in gap 62 between (i) metal cup diaphragm 46 and (ii) lens 54 are indicative of the pressures to be measured. (col. 5, lines 18-21). Metal cup diaphragm 46 has protrusion 66 and tip 68 extending in the same direction into a singular plane “to prevent thermal expansion of diaphragm 46 from changing the distance across gap 62.” (col. 5, lines 42-51).

Lens 54 is supported by support means 47, which includes support head 48, swivel support 50 and swivel member 52. (col. 3, lines 30-32). Support head 48 comprises first half 70 and second half 72, which are made from materials having different coefficients of thermal expansion. (col. 5, lines 52-66). The gross or cumulative coefficient of thermal expansion of support head 48 can further be controlled by varying the longitudinal lengths of halves 70 and 72. (col. 6, lines 14-29). The selection of materials and lengths for support head 48, swivel support 50 and swivel member 52 provides a “nested cylinder arrangement[, which] allows for cascading the coefficients of thermal expansions for these different members so that they combine to cancel out any thermal displacement between them to prevent variations in temperatures from changing gap 62.” (col. 8, lines 28-46; *see also* col. 7, line 29 to col. 8, line 27).

Smith is precisely the type of pressure-only sensor with mechanical temperature compensation that Wavering critiques and teaches away from, discussed above. In the

first Amendment, Applicant had argued against a hypothetical combination of Wavering and Lu, which similar to Smith is another temperature-compensated pressure sensor. The fact that the Examiner is not asserting the Wavering and Lu combination in the present Office Action indicates that this argument was persuasive.

For these reasons, claim 1 as amended is patentable over Wavering and the combination of Wavering and Smith (or Wavering and Lu), or any other temperature-compensated optical pressure sensor.

The remaining claims are dependent directly or indirectly on claim 1 and recite further limitations therefrom. Hence, these claims are presently allowable based on their dependency. Applicants believe that it is unnecessary to address the rejections of the dependent claims at this time, but reserve the right to further support their patentability should that becomes necessary.

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

If a fee for extension of time is required, it is hereby petitioned for under 37 C.F.R. § 1.136, and if any other required fee is due, the Commissioner is authorized to charge appropriate fees to H.T. Than Law Group, Deposit Account No. 50-1980.

Respectfully submitted,

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/H.T. Than/

H.T. Than (Reg. No. 38,632)
Attorney for Applicants
The H.T. Than Law Group
Waterfront Center
1010 Wisconsin Avenue, N.W.
Suite 560
Washington, DC 20007
Telephone: (202) 363-2620
Facsimile: (202) 363-3490